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REMARKS:

By this amendment claims 6, 12, 17, 23, 28, and 31-33 have been amended; no new claims have been added. Claims 6, 7, 9 - 12, 15-18, 20 and 22 - 36 are now pending for consideration.

Claim Rejections under 35 US 103

Claims 6, 7, 9 - 12, 15-18, 20 and 22 – 36 now pending in the application stand rejected under 35 US 103 as being unpatentable over US Patent No. 5,963,209 (Hoppe) in view of US Patent 5,546,530 (Grimaud).

The primary basis in the grounds of rejection is an assertion that it would have been *obvious* *"to use the plurality of computers [parallel processing] of Grimaud with the system of Hoppe because this would have saved memory in the computer generating the image . . .."* No factual supported explanation is given as to how the Examiner considers Grimaud might have been used with the system of Hoppe and with respect, the rejection is traversed as failing to state and support a prima facie case of obviousness. As the Examiner will be aware, each reference must be considered as a whole in the context of its own teaching and the prior art must teach of suggest the desirability of the invention including all the limitations as defined in the claims under rejection. It is believed tae Examiner has arbitrarily selected one feature of Grimaud and to speculate use *"with the system of Hoppe"* in an unspecified manner, which is inadequate to establish a prima facie case of obviousness.

Hoppe discloses a display system which "comprises a transmitting computer 232 (such as a network or file server) and a receiving computer 233 (such as a client computer station or terminal) which are linked via a communications link 234. . . . The transmitting computer 232 store a PM representation of an arbitrary mesh $\underline{M}$ in a database 240 of three dimensional models, and runs a progressive transmission software application that implements a transmitting process 244 (FIG. 12(a)) for transmitting a PM representation in the database 240 to the receiving computer on the communications link 234. The receiving computer 233 runs a progressive transmission software application that implements a receiving process 246 (FIG. 12(b)) for receiving the PM representation from the communication link 234 and rendering views of the mesh at progressively finer levels of detail." (Col. 17:33-60.)

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In contrast, Grimaud discloses an animation system including a control computer 12 and a plurality of graphics elements 100A-100E in a system which "may comprise a monolithic board with the processors already in place or, alternatively, a bus with card slots so that users may add processors as desired" (col. 2, lines 41-44). The system 50 shown by Grimaud in FIG. 2 "is capable of rendering images for one eye" (col. 3: 50-53), i.e. two such systems would be required to implement Grimaud's overall animation system in the manner shown in FIG. 2. Grimaud teaches: "Each graphics element 100A-100E communicates red-green-blue (RGB) information to a corresponding buffer element 104A-104E in a buffer 110 over RGB buses 108A-108E" (col. 3: 62-650 In addition, Grimaud teaches that on completion of image rendering by the graphics elements 100A-100E, "the image data is communicated to buffer 110" (col. 5: 6-8) of the graphics elements 100A-100E and "the composite image may be constructed by storing the emerging pixel data in a frame buffer 180 resident within the buffer control unit 112" and then communicated over a bus 50 (or 54) to a head mounted display 16; alternatively, "the emerging pixel data is converted to NTSC format and communicated directly to headset 16" (col. 5: 16-22).

Grimaud's processor card and board implementation of his animation system thus differs in kind and functionality from Hoppe's communications network linked workstation based system for encoding and transmission of progressive meshes. The Examiner has made no factual showing of how Grimaud or Hoppe might be modified *"to use the plurality of computers [parallel processing] of Grimaud with the system of Hoppe"*. Arbitrary selection of one feature of Grimaud, out of context, and unsupported speculation that it might be used in Hoppe is an improper basis for a rejection under 35 US 103.

As discussed above, Hoppe teaches that the transmitting computer 232 transmits a "PM representation in the database 240 to the receiving computer on the communications link 234. The receiving computer 233 runs a progressive transmission software application that implements a receiving process 246 (FIG. 12(*b*)) for receiving the PM representation from the communication link 234 and rendering views of the mesh at progressively finer levels of detail." (Col. 17:33-60.) This functionality and manner of operation are inconsistent with Grimaud's teaching that image data from the graphics elements 100A-100E are stored in a frame buffer 180 and then communicated directly to the display 16 over the bus 50 (54). Grimaud teaches

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construction of a composite image in the buffer 180 and then direct communication of the composite image over a bus to the head mounted display 16, without image processing or rendering by the computer 12, let alone of rendering in a manner necessary to implement the receiving process 246 (Hoppe Fig. 12B) required of the receiving computer 233 by Hoppe Hoppe's functionality. To ignore the teaching by Grimaud of creation of the composite image prior to communication directly to a display would at a minimum impermissibly change the principle of operation of Grimaud's animation system. To attempt, hypothetically, to implement Grimaud's teaching of direct communication of the composite image from the buffer 180 to a display would be contrary to Hoppe's teaching that his "receiving computer 233 runs a progressive transmission software application that implements a receiving process 246 (FIG. 12(b)) for receiving the PM representation from the communication link 234 and rendering views of the mesh at progressively finer levels of detail" (Col. 17:33-60), and would render Hoppe unsatisfactory for its intended purpose. Consequently, there would have been no motivation *"to use the plurality of computers [parallel processing] of Grimaud with the system of Hoppe"* as speculated by the Examiner.

With respect to the invention as claimed in the present application, claim 6 presented herein explicitly recites:

> "A method for utilizing a network of computers to render a three dimensional scene, comprising . . . operating the plurality of other computers in parallel to create respective LOD mesh representations of the selected three dimensional objects stored at the other computers; and communicating the respective LOD mesh representations of the selected three dimensional objects from the plurality of other computers in parallel over the network to the first computer, and processing the received LOD mesh representations in a graphics rendering pipeline in the first computer to create a display image of a three dimensional scene."

Claim 12 includes recitation of a computer system for rendering a three dimensional scene, in which:

> ". . . the workstations are responsive to received requests to operate in parallel to create LOD representations of the respective stored three dimensional objects identified by the requests received from the visualization console and to communicate the LOD representations of the selected three dimensional objects in parallel to the visualization console for rendering by the visualization console graphics processor to create a composite image display representation by the visualization console display of the selected view of the three dimensional scene."

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Claims 17, 23, 28, 31, 32 and , 33 include similar subject matter features. Both features are clearly distinct from and not suggested by Hoppe or Grimaud. Grimaud teaches that on completion of image rendering by the graphics elements 100A-100E, "the composite image may be constructed by storing the emerging pixel data [from buffer elements 104A-104E] in a frame buffer 180 resident within the buffer control unit 112" and then communicated over the bus 50 to the head mounted display 16. There is no teaching or suggestion by Hoppe or Grimaud that "selected data objects [are communicated] in parallel" to a display or by Grimaud that the "composite image" data from the buffer 180 are processed by computer 12. Consequently, the Examiner has not made a factual showing that Grimaud "used with Hoppe" would result in a method having the whole combination of steps recited in any of claims 6, 23, 28 or 31 or a computer system having the whole combination of features recited in any of claims 12, 17, 32 or 33. Consequently, a prima facie case of obviousness has not been established and the above discussion has shown that combination of Hoppe and Grimaud would not have been obvious. Claims 6, 12, 17, 28, 31, 32 and 33 are believed free from the grounds of rejection set forth in the Office Action and to be allowable over the cited art, together with their dependent claims.
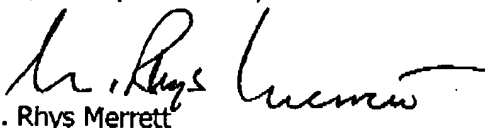
CONCLUSION:

It is believed that all of pending claims 6, 7, 9 - 12, 15-18, 20 and 22 - 36 are in condition for allowance; favorable consideration and early allowance of the application are respectfully solicited. If there are any remaining issues that could be resolved by discussion, a telephone call to the undersigned attorney at (972) 862-7428 would be appreciated.

Attached hereto is a marked up version of the changes made to the claims by the current amendment. The attached page is captioned **Version with markings to show changes made."**

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the claims:

The following claims have been amended as shown:

6. (Twice Amended) A method for utilizing a network of computers to render a three dimensional scene, comprising:

sending a plurality of requests from a first computer to a plurality of other computers over a high speed network, the plurality of other computers each storing high resolution three dimensional scene objects, wherein the requests identify selected three dimensional objects stored at the plurality of other computers ;

operating the plurality of other computers in parallel to create a-respective LOD mesh representations of the selected three dimensional objects stored at the other computers; and

communicating the respective LOD mesh representations of the selected three dimensional objects from the plurality of other computers in parallel over the network to the first computer, the first computer renderingand processing the received LOD mesh representations in a graphics rendering pipeline in the first computer to create and creating a display thereofimage of a three dimensional scene.

12. (Twice Amended) A computer system for rendering a three dimensional scene, comprising:

a visualization console including a graphics processor and a display;

a plurality of workstations, connected to the visualization console by a high speed network to enable the visualization console and the plurality of workstations to operate together;

each of the plurality of workstations storing three dimensional objects, the stored three dimensional objects collectively representing a three dimensional scene; and

identification information stored at the visualization console identifying storing identifiers of each of the three dimensional objects stored at the plurality of workstations;

wherein the visualization console is operable under user control to communicate requests to the plurality of workstations over the high speed network, said requests including

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identifiers of identifying respective selected ones of the three dimensional objects stored at the workstations representing a selected view of the three dimensional scene;

the workstations are responsive to received requests to operate in parallel to create LOD representations of the respective stored three dimensional objects identified by the requests received from the visualization console and to communicate the LOD representations of the selected three dimensional objects in parallel to the visualization console for assembly rendering by the visualization console graphics processor to create into a composite image display representation by the visualization console display of the selected view of the three dimensional scene.

17. (Twice Amended) A computer system for rendering a three dimensional scene, comprising:

a visualization console including a graphics processor and a display;

a plurality of workstations, connected to the visualization console by a high speed network;

means for sending requests from the visualization console to the plurality of workstations over the high speed network, wherein the requests identify three dimensional objects stored at the plurality of workstations;

the workstations including means operable in parallel for creating a LOD representation of each three dimensional object stored at a respective workstation and that is identified by a request received from the visualization console; and

each said workstation workstations also including means for effecting parallel communicationing of the LOD representations of the three dimensional objects to the visualization console, and

the visualization console including graphics processing means for assembling the received LOD representations of the three dimensional objects into a three dimensional scene image display by said visualization console display.

23. (NewAmended)   A method of displaying a three dimensional scene image, comprising:

from a first computer coupled to a display, transmitting a retrieval request to each of a plurality of second computers storing three dimensional scene objects distributively stored at

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said second computers together with associated identifiers, said stored three dimensional scene objects collectively representing a three dimensional scene, said retrieval request including identifiers associated with stored scene objects representing at least a portion of the three dimensional scene selected for display;

the second computers retrieving and processing in parallel three dimensional scene objects -stored at individual ones of the second computers based on each-matches between a three dimensional scene object identifiers in the received request and a-three dimensional scene objects identifier-stored at that-the second computers, the processing by the second computers creating respective meshes of the retrieved three dimensional scene objects at a selected level of detail;

the second computers communicating the processed three dimensional scene object meshes in parallel to a graphics rendering pipeline processor in the first computer to render and create a display a representation of the selected portion of the three dimensional scene assembled from the three dimensional scene object meshes communicated by the plurality of second computers to the first computer.

28. (NewAmended)   A method of displaying a three dimensional scene image, comprising:

from a first computer coupled to a display, transmitting a retrieval request to each of a plurality of second computers storing three dimensional scene objects distributively stored at said second computers, said retrieval request including parameters describing a selected part of the three dimensional scene to be displayed;

the second computers responding to the retrieval request by selectively retrieving and processing in parallel according to said parameters, three dimensional scene objects stored by the second computers, the processing by the second computers creating respective meshes of the retrieved three dimensional scene objects at a selected level of detail; and

the second computers communicating the processed three dimensional scene object meshes in parallel to a graphics rendering pipeline in the first computer to create on said display a representation of the selected part of the three dimensional scene assembled from the three dimensional scene object meshes communicated by the plurality of second computers to the first computer.

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31. (~~New~~Amended)   A method of displaying a three dimensional scene image, comprising:

Initially, from a first computer coupled to a display, transmitting to and distributively storing at a plurality of second computers a plurality of three dimensional scene objects together with associated identifiers, said three dimensional scene objects stored at the second computers collectively representing a three dimensional scene, and storing at the first computer, identifiers for the respective three dimensional scene objects stored at the plurality of second computers;

subsequently, transmitting retrieval request from the first computer to the plurality of second computers, said retrieval requests including identifiers associated with selected ones of the three dimensional scene objects distributively stored at said second computers representing a portion of the three dimensional scene selected for display;

the second computers retrieving and processing in parallel three dimensional scene objects stored at individual ones of the second computers based on each match between a three dimensional scene object identifier in the received request and a three dimensional scene object identifier stored at that second computer, the processing by the second computers creating respective meshes of the retrieved three dimensional scene objects at a selected level of detail;

the second computers communicating in parallel the processed three dimensional scene object meshes to a graphics rendering processor of the first computer to create on said display a representation of the selected portion of the three dimensional scene assembled from the three dimensional scene object meshes communicated by the plurality of second computers to the first computer.

32. (Amended)   A computer system for rendering a three dimensional scene, comprising:

a first computer including a display;

a plurality of workstations operably coupled to the first computer by communication network;

each workstation storing three dimensional scene objects, the three dimensional scene objects stored by the workstations collectively representing a high resolution three dimensional scene;

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the first computer storing an object identifier for each three dimensional scene object stored at the plurality of workstations; the first computer operable to send over said communication links a retrieval request to the plurality of workstations including object identifiers and locations associated with a selected plurality of said stored three dimensional scene objects representing a selected portion of said three dimensional scene;

the workstations operable in parallel to retrieve and process three dimensional scene objects stored at individual ones of the workstations corresponding to object identifiers in the received request to create respective meshes of the retrieved three dimensional scene objects at a selected lower resolution and to communicate the processed three dimensional scene object meshes in parallel over the communication network to the first computer; and wherein

the first computer includes a graphics processor is-operable to render the received three dimensional scene object meshes and to create a on said display a representation of said selected portion of the three dimensional scene.

33. (Amended)   A computer system for rendering a three dimensional scene, comprising:

a first computer including a graphics rendering pipeline and a display;

a plurality of workstations operably coupled to the first computer by communication network;

a database of three dimensional scene objects collectively representing a three dimensional scene, said database accessible by the workstations;

each workstation storing references to said database entries;

the first computer operable to send over said communication links a retrieval request to the plurality of workstations identifying a selected plurality of said stored three dimensional scene objects representing a selected view of said three dimensional scene;

the workstations operable in parallel to retrieve and process three dimensional scene objects based on the retrieval request to create respective meshes of the retrieved three dimensional scene objects at a selected level of detail and to effect parallel communication of communicate the processed three dimensional scene object meshes over the communication network to the graphics rendering pipeline of the first computer; and wherein

the first computer is operable to create on said a-display a representation of the selected view of the three dimensional scene from the received three dimensional scene object meshes.

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